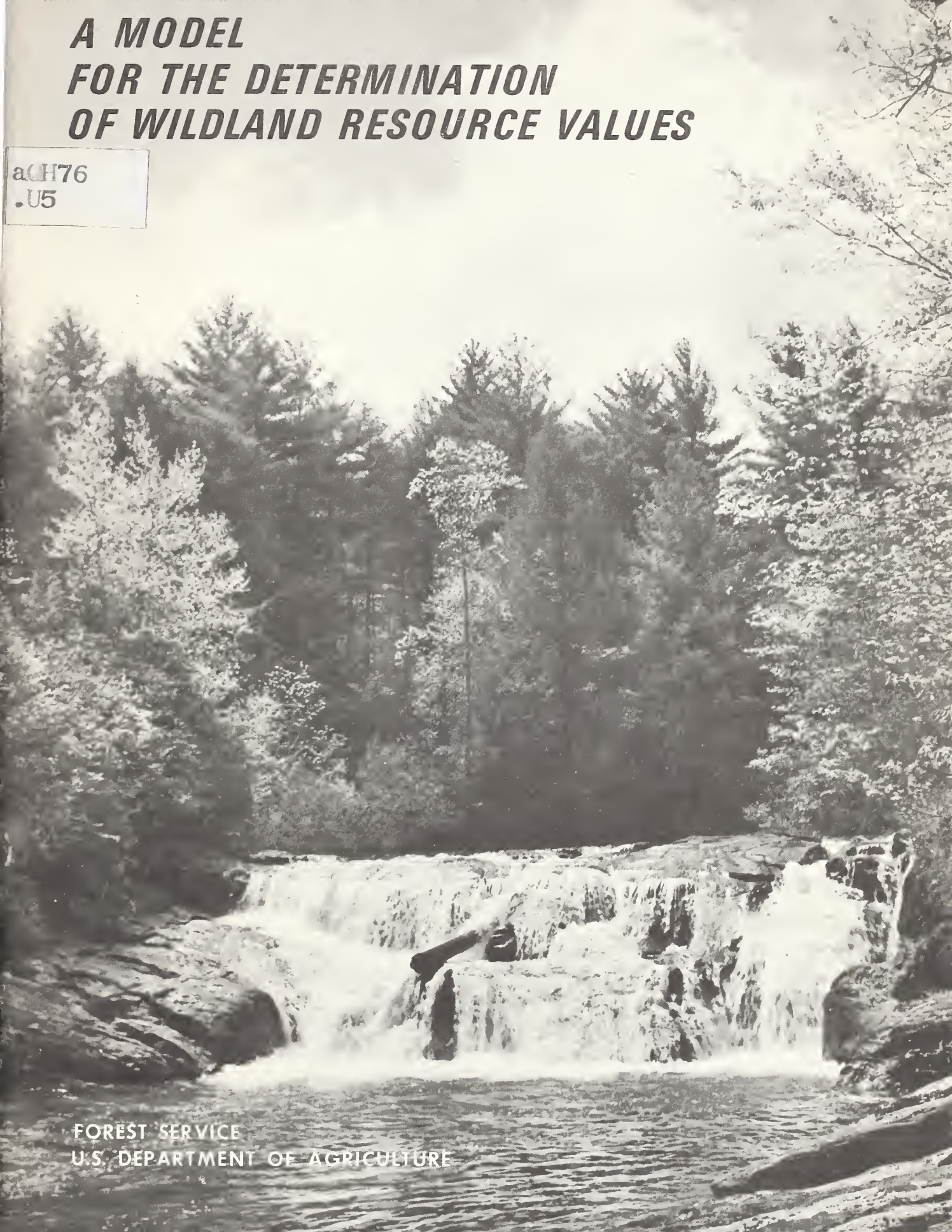
A MODEL FOR THE DETERMINATION OF WILDLAND RESOURCE VALUES



FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

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PREFACE

In December 1967 the Clarke-McNary Section 2 Study Committee of the National Association of State Foresters appointed a "Values-at-Risk Task Force." The responsibility given to the Task Force was to study various possibilities and attempt to develop a simple, workable system for determining on an interim basis the total value of all damageable resources on protected lands. Complicated formulas and involved procedures were to be avoided.

The Task Force met on at least six different occasions, reviewed many pages of comments from State and Federal Fire Protection personnel, and developed and tested a variety of approaches to meeting the assigned responsibility. This report presents a model for the determination of wildland resource values developed by the Task Force in cooperation with a two man Working Group. As you read, please keep the following important points in mind:

1. This is an interim report developed by operations personnel to furnish much needed information now.
2. All States do not have the same reservoir of statistical information. Therefore the model had to be geared to the types of input information generally available to all State forestry agencies.
3. Those States with more detailed inputs are free to use them in the model for in-State purposes.
4. The Task Force recognizes inherent weaknesses in some of the procedures used and assumptions made in developing the model. However, it is believed that the best choice was made where limited information was available.

Each State Forester has already used the model to determine the total value of all damageable resources on protected lands for his State.

The C-M 2 Study Committee requests you, as an interested reader, to study this model, review the procedures, and send your criticisms and comments to:

Director,
Division of Cooperative Forest Fire Control
Forest Service - U.S. Department of Agriculture
Washington, D.C. 20250

INTRODUCTION

Certainly many volumes have been written and endless speeches delivered emphasizing the social and economic implications of our forest-related resources. We speak in glowing terms of their beauties and benefits, yet little is to be found in the literature which deals with the monetary value of the intangible resources. Today our lawmakers and other public officials must be well-versed about resource problems. Sometimes their success in public life depends on how well they deal with these issues. Mass media and modern communications bring the resource problems and needs into every home in the country. The man-on-the-street is expressing his opinion, especially at the polls, on issues dealing with water, recreation, and wildlife. Indeed, with the public's leisure time increasing, the forests are moving ever closer to our doorstep. We are more concerned about floods, water shortage, soil, trees, and environment than were our parents. We are becoming a Nation more conscious of our natural resources and we need to know the values at risk in neglect of them.

The working group studied these resources by examining written material and interviewing many subject matter specialists. Unfortunately, however, little information was available on some intangible resources, such as life and health, simply because human feelings were involved. So, to accomplish the purpose of this study, it was determined to use the best measurements available. Only direct and "on site" values were considered, while data involving secondary and tertiary benefits were strictly avoided. Thus, beginning with some basic information and generally accepted values, procedures were developed and certain gaps were bridged with the application of other known measures.

This study provides an interim system for determination of the protected area values for use on a Statewide basis and is not designed to be used for any smaller area.

Finally, it must be stated that this study recognizes that there are a number of lesser values not considered. This might include air-conditioning benefits, spiritual and health values, and conservation education.

RESOURCE VALUES

TIMBER

Market price is the basis for determination of the timber values on the protected area. With unit prices provided by the State Foresters, and the statistics of volume and area found in *"Timber Trends in the United States"* (Forest Resource Report No. 17, USDA Forest Service, 1965), it is simple to compute values. This study has not devised a reduction system to provide for operability of the timber because of the wide variation from State to State; nevertheless, a reducing factor should be applied. The value of seedlings and saplings is necessarily placed on an acre basis because of the available statistics. By discounting the mature timber value at an acceptable rate, the value of seedlings and saplings is established. New and better unit prices of sawtimber and cordwood can be substituted if and when available.

Almost half of the 1,134,224,000 acres of protected area is defined as commercial forests, while the remainder is classified as non-commercial, non-productive, and productive reserves. The greatest timber volume is in the far West while substantial, but less, volume exists in each of the eastern, southern, and Rocky Mountain sections. Although nearly equal in timber volume, the eastern half of the United States far exceeds the western half in commercial forest area.

Based on projections, future timber needs are reasonably well known. Projected estimates show a probable need of nearly double our present demand for timber products by the year 2000. This projection is based on the assumption that our population and our business activity will greatly expand in the next generation. Although some wood products have decreased in measuring total raw materials used, this loss has been made up by increased use in other wood products, such as container board, plywood, and fiber products.

Timber represents material goods commonly sold at known prices. Since there is little reason to use any other procedure, the market value method is used to establish monetary value in this study. Since this study is dealing with timber resources on the land, it would be unrealistic to select a point of value in timber processing other than stumpage.

The following sections present: 1) The procedure to determine timber value; 2) tables of stumpage and volume data, and seedling and sapling discount data for use in the formula for obtaining timber value; 3) the formula; and 4) application of the formula.

Procedure to Determine Timber Value

The stumpage prices reported by the State Foresters and the current prices of USDA Forest Service sales have been studied and found to be in general agreement. Basic acreage and volume data are from *Timber Trends* (1965).

In the case of sawtimber, value is found using Table 11 (*Timber Trends*) with the application of stumpage prices given in this study.

Cordwood value is computed by use of poletimber volumes, Table 8 (*Timber Trends*), then dividing by a national average of 70 cu. ft. per cord for poletimber and applying stumpage prices computed in this study.

For seedling and sapling values, the average acreage value of commercial timber is computed, and bankers discount applied to take merchantable timber back to the present age of seedlings and saplings. Finally, this average acre value is multiplied by acreage of seedlings and saplings.

Inoperable timber has presented a problem in this study. The volumes reported in *Timber Trends* do not consider operability. No overall percentage has been devised as a reduction factor since it varies from area to area and State to State. However, to be fair in this evaluation, a reducing factor should be applied. In some areas, it might be 5 percent, in others 10 percent, while in others 20 percent or higher.

Discount Tables for Seedlings and Saplings

Values established for sawtimber and polewood in the Appendix of *Timber Trends* are reduced to per acre basis for "E" in the formula for obtaining timber value (p. 6). Then the approximate years of discount are applied to the value per acre to take the value back to the average age of seedlings and saplings. Finally this per acre value is multiplied by the acres as shown in Table 3, column 6 of *Timber Trends*.

Credit line: Photo courtesy Pennsylvania Dept. of Forests and Waters, Harrisburg, Pa. 17120.

Table 1.—Stumpage values of commercial timber in the United States[1]

State	Hard saw	Soft saw	Hard pole	Soft pole
	MBF	*MBF*	*Cord*	*Cord*
Alabama	$15.00	$30.00	$2.00	$6.00
Alaska	3.50	6.00	.65	.65
Arizona	2.00	10.00	1.00	1.00
Arkansas	17.00	38.00	1.50	4.35
California	3.00	26.75	1.50	2.00
Colorado	2.25	8.00	1.00	1.00
Connecticut	16.00	15.00	1.00	1.00
Delaware	20.00	40.00	3.00	4.00
Florida	20.69	36.54	2.02	8.38
Georgia	17.00	35.00	2.50	7.00
Hawaii	10.00	10.00	30.00	20.00
Idaho	2.00	10.00	5.00	3.00
Illinois	23.23	26.00	.80	2.00
Indiana	22.50	15.00	1.30	1.15
Iowa	38.00	15.00	2.00	2.00
Kansas	22.26	10.00	10.00	5.00
Kentucky	23.00	18.00	1.50	3.00
Louisiana	18.00	35.00	1.80	4.50
Maine	18.00	16.00	2.00	4.00
Maryland	17.40	20.00	1.08	2.58
Massachusetts	30.00	15.00	2.00	1.00
Michigan	28.72	8.65	1.30	3.72
Minnesota	5.33	12.23	1.14	3.69
Mississippi	20.00	20.50	2.00	5.00
Missouri	34.00	20.00	.75	7.00
Montana	3.50	5.00	1.00	2.50
Nebraska	10.00	8.00	1.00	1.25
Nevada	2.00	10.00	5.00	3.00
New Hampshire	15.00	15.00	2.00	4.00
New Jersey	32.50	20.00	1.00	3.00
New Mexico	2.50	10.00	.50	.50
New York	35.00	15.00	1.75	3.00
North Carolina	18.00	30.00	2.50	5.00
North Dakota	6.00	--	4.00	--
Ohio	28.00	18.00	2.25	1.40
Oklahoma	15.00	30.00	1.50	2.00
Oregon	12.84	33.39	.50	.50
Pennsylvania	17.40	20.00	1.08	2.58
Rhode Island	12.50	15.00	1.25	1.62
South Carolina	25.00	35.00	3.00	7.00
South Dakota	4.50	11.00	1.00	1.75
Tennessee	25.00	30.00	3.00	5.00
Texas	20.00	30.00	2.00	4.00
Utah	2.25	12.00	1.00	1.00
Vermont	45.00	35.00	1.00	2.50
Virginia	20.00	28.00	2.00	6.00
Washington	12.84	30.00	.50	.50
West Virginia	24.00	15.00	1.28	1.28
Wisconsin	23.50	24.60	1.90	4.95
Wyoming	1.00	4.40	.50	1.00

[1] Based on data taken from Tables 8 and 11 (volumes as of Jan. 1, 1963), *Timber Trends in the United States,* FRR No. 17, Feb. 1965 (Use more recent inventory data if available).

Table 2.—Timber volumes on commercial forest land in the United States[1]

State	Hardwood sawtimber	Softwood sawtimber	Hardwood poletimber	Softwood poletimber
	MMBF	*MMBF*	*MMCUFT*	*MMCUFT*
Alabama	18,295	28,307	2,775	2,001
Alaska	7,143	208,371	3,540	6,833
Arizona	189	28,098	64	419
Arkansas	15,985	26,363	3,036	1,225
California	1,614	302,298	311	4,862
Colorado	3,781	60,477	1,741	3,378
Connecticut	2,087	190	827	54
Delaware	709	546	133	82
Florida	6,781	15,253	908	1,405
Georgia	18,448	29,408	3,310	3,372
Hawaii	722	--	45	--
Idaho	317	126,484	206	4,553
Illinois	8,548	28	810	10
Indiana	12,503	62	1,141	17
Iowa	6,188	6	360	3
Kansas	4,270	10	331	4
Kentucky	26,776	2,485	3,838	219
Louisiana	27,140	25,140	3,292	1,225
Maine	10,625	20,657	3,643	6,268
Maryland	7,123	1,669	1,125	330
Massachusetts	1,702	851	995	248
Michigan	19,096	7,400	5,581	1,698
Minnesota	8,959	6,560	4,686	2,295
Mississippi	9,253	17,111	1,993	1,321
Missouri	11,733	879	2,669	150
Montana	838	111,799	101	6,328
Nebraska	1,249	423	79	23
Nevada	7	565	24	17
New Hampshire	3,152	5,859	1,428	1,037
New Jersey	2,939	604	449	135
New Mexico	1,870	29,872	218	938
New York	24,974	7,009	5,393	858
North Carolina	27,437	28,006	4,210	2,586
North Dakota	637	--	175	--
Ohio	16,368	409	1,565	35
Oklahoma	2,271	2,483	488	155
Oregon	20,430	515,879	2,379	9,411
Pennsylvania	25,381	2,351	7,617	309
Rhode Island	165	27	142	7
South Carolina	11,001	13,990	1,458	1,269
South Dakota	705	52	217	2
Tennessee	16,325	4,328	2,704	461
Texas	9,958	21,667	1,454	1,247
Utah	2,128	20,213	939	637
Vermont	6,329	2,784	1,926	520
Virginia	24,419	12,701	3,974	1,654
Washington	14,404	358,661	2,130	10,997
West Virginia	28,834	1,565	4,611	222
Wisconsin	12,095	4,201	5,016	670
Wyoming	385	27,939	230	2,007

[1] Based on data taken from Tables 8 and 11 (volumes as of Jan. 1, 1963), *Timber Trends in the United States,* FRR No. 17, Feb. 1965. (Use more recent inventory data if available.).

Table 3.—Area of sawtimber, poletimber, seedlings and saplings on commercial forest land in the United States (thousand acres)[1]

State	Sawtimber & poletimber	Seedling & sapling stands	State	Sawtimber & poletimber	Seedling & sapling stands
Alabama	16,046	5,588	Nebraska	620	115
Alaska	20,991	7,227	Nevada	105	1
Arizona	3,709	21	New Hampshire	4,063	677
Arkansas	15,750	5,200	New Jersey	1,255	724
California	13,561	76	New Mexico	5,788	159
Colorado	11,342	499	New York	9,305	2,406
Connecticut	1,399	529	North Carolina	15,524	4,013
Delaware	340	45	North Dakota	231	156
Florida	8,226	3,741	Ohio	4,420	645
Georgia	13,585	11,959	Oklahoma	3,020	2,130
Hawaii	534	54	Oregon	21,919	3,765
Idaho	12,652	1,598	Pennsylvania	11,184	3,416
Illinois	3,105	613	Rhode Island	248	169
Indiana	3,318	582	South Carolina	8,180	2,655
Iowa	1,836	287	South Dakota	1,466	190
Kansas	1,312	188	Tennessee	9,670	3,864
Kentucky	8,532	1,734	Texas	10,220	1,500
Louisiana	13,510	2,150	Utah	3,754	218
Maine	14,710	1,900	Vermont	3,189	340
Maryland	2,312	451	Virginia	13,807	1,744
Massachusetts	1,952	1,271	Washington	16,452	2,424
Michigan	9,128	6,845	West Virginia	8,710	2,445
Minnesota	10,907	4,294	Wisconsin	7,056	5,787
Mississippi	12,870	4,710	Wyoming	4,507	235
Missouri	8,434	3,563	Total	389,349	106,479
Montana	14,595	1,576			

[1] Based on data taken from Tables 8 and 11 (volumes as of Jan. 1, 1963), *Timber Trends in the United States,* FRR No. 17, Feb. 1965. (Use more recent inventory data if available.)

Data below are based on a value of $1.00 at 5 percent, at the beginning of the period, received after an interest-bearing period of years *(Forestry Handbook,* Edited by R. D. Forbes for the Society of American Foresters, 1955).

Years	*Discount Factor*
15	.4810
20	.3769
25	.2953
30	.2314
35	.1813
40	.1420
45	.1113
50	.0872
55	.0683
60	.0535
65	.0420
70	.0329
75	.0258
80	.0202
85	.0158
90	.0124
95	.0097
100	.0076

Example Using This Data: 1,000 acres of seedlings and saplings with average age of 15 years. Present value of timber in State is $80.00 per acre. Normal rotation is 50 years. 50 − 15 = 35 years.
.1813 X $80.00 X 1,000 = $14,504 (discount value).

Formula for Obtaining Timber Value

(A + B + C + D + E) − F = Value of timber.

A = (Volume of softwood sawtimber x Unit price) = Value softwood sawtimber

B = (Volume of hardwood sawtimber x Unit price) = Value hardwood sawtimber

C = (Volume of softwood poletimber x Unit price) = Value softwood poletimber

D = (Volume of hardwood poletimber x Unit price) = Value hardwood poletimber

$$E = \frac{A + B + C + D}{\text{Acres of sawtimber \& poletimber}} \times \text{Discount value} \times \text{Acres of seedlings \& sapling stands}$$

= Value seedlings and saplings

F = Reduction factor to provide for inoperable stands. (Judgment should be exercised in applying this factor. It may be a 5 percent, 10 percent, 20 percent, or even higher.)

See sample of application following.

Sample

Timber		State A
A. Softwood sawtimber x stumpage	=	Value
13,900,000 MBF x $35/MBF	=	$489,650,000
B. Hardwood sawtimber x stumpage	=	Value
11,001,000 MBF x $25/MBF	=	$275,025,000
C. $\frac{\text{Softwood cu. ft.}}{70}$ x $/cord	=	Value
$\frac{1,269,000,000}{70}$ x $7	=	$126,900,000
D. $\frac{\text{Hardwood cu. ft.}}{70}$ x $/cord	=	Value
$\frac{1,458,000,000}{70}$ x $3	=	$62,485,714
Total (A + B + C + D)		$954,060,714

E. $\frac{A + B + C + D}{\text{Acres sawtimber \& polewood}}$ x Discount value x Area of seedlings & saplings

= Value

$\frac{\$954,060,714}{8,180,000}$ x .2953* x 2,655,000

= $91,438,200

Total (A + B + C + D + E) = $1,045,498,914

F. 5% Reduction for inoperable stands −52,274,945

$993,223,969

Total Value of Timber $993,223,969

*35-yr. Rotation
10-yr. Average age
25-yr. Discount

For further reference:

Forestry Handbook, Society of American Foresters, Washington, D.C. 20036. 1955.

Journal of Forestry, Society of American Foresters, Washington, D.C. 20036

Study of Timber Policy, Public Land Law Review Commission, Washington, D.C. 20006

Timber Trends in the United States, Forest Service, U.S. Department of Agriculture, Washington, D.C. 20250. 1965.

WATER

Research has shown that the protected lands of the Nation have the characteristics of storing, regulating the flow, and retaining the quality of water. Benefits of protection are also demonstrated in reduced sedimentation and flooding. Water serves many purposes in all conditions of purity. But what is water worth? The price at the point of consumption (production cost) is generally used in determining value. This is the cost of bringing water to the user, whether it is the farmer, the paper mill, or the private home. However, when water rates quoted in communities, cities and industrial plants are discounted for installations and production costs, the value is zero at the point of origin in the protected area. Of course, we do not accept this as the true value of water; but, unfortunately, no research data is available to help establish a value.

Therefore, this study takes the liberty of using a known measure. This adopted system measures water value on the protected area as one-tenth of its market price when impounded, piped, and treated.

Essentially the same amount of water exists today as did at the dawn of history. There are large underground reservoirs in many sections of our country, which depend on precipitation for replenishment. Although every area of the United States has dry and wet years, the total rainfall is equal on an average to 22,000 gallons each day for every man, woman, and child. However, only a portion of this is available for use. Transpiration and evaporation account for more than two-thirds of the total. The U.S. Geological Survey estimates that an average of 6,000 gallons daily per capita runs off the surface into streams and into the ocean. The U.S. Department of Commerce estimates that less than one-third of the 6,000 gallons is available for consumption during most of the year. The National per capita withdrawal is approximately 1,100 gallons per day. Of this withdrawal, some water is consumed while other water is either all or partly returned to the streams.

Irrigation, which accounts for about 40 percent of our total national water withdrawal, is the biggest single use, representing 83 percent of consumption. This is especially significant in the 17 western States where, because of irrigation, the per capita use may go as high in some States as 6,000 to 7,000 gallons per person per day. Both surface and underground water is used.

The vegetative cover in the protected areas of the United States has proven effective in lessening the degree of flooding and reducing sedimentation. In general, forest soils have higher infiltration capacities than agricultural soils, grass, or soils of open lands. As a result, they are very important in reducing sedimentation and stabilizing slopes. Studies acknowledge these beneficial effects, but it is most difficult to get value figures which can be applied to protected areas in each State.

The difficulty in determining the value of forest and watershed lands in preventing flood and erosion is the fact that the resource values protected are primarily *downstream* and physically separated from the area protected. The problem is further complicated because the amount of downstream damage is extremely sensitive to the size of the denuded upstream watershed. Studies in southern California have shown that flood damages increase exponentially with fire size. Based on the meager data available, for this study we assumed that the downstream values potentially threatened with floods from protected watersheds are 10 times the per-acre value of the improvements on the protected lands themselves.

Several research studies are in progress to determine the "upstream" or the "watershed" value of water. As far as we can determine, values are being based on the gross local products produced. This is true of the San Juan River Diversion Study in New Mexico. This diverted water pouring into the Rio Grande River provides added value to the gross national product through agriculture and manufacturing. It was determined not to use either local or gross national product to reflect the value of water because water is but one of the many elements used in manufacturing or developing the finished products which represent the GLP or GNP.

To determine the value of water, this study uses a reducing factor to discount the metered water price back to its source on protected land. This computation represents the "stumpage" value of water: the ability of the protected land to *store water, regulate flow,* and *retain quality* and to *lessen sedimentation* and *flood severity*. The reducing factor is developed from a parallel drawn between water in the protected area and tree stumpage. In the case of tree stumpage, it is an established fact that the value will increase about 10 times between standing tree and lumber. It is our contention that water likewise can have the same increase in value from the time it falls on the protected area to the point it is made available for domestic and commercial use. Therefore, a discount factor of .10 is applied to the metered price. The American Water Works Association has developed statistics for hundreds of municipal and private water companies. These tables have been updated with respect to cost-of-living, and placed on an acre-inch basis. Note that basic price figures used in the formula are the metered rates; the reason for this is to achieve national uniformity. Generally speaking, the water being metered and priced is of the same standard and quality level in each State. Although irrigation water represents an extremely heavy use, its values are difficult to develop because of non-uniformity in use. For instance, in some States it is free. Actually, irrigation water might be considered to be the primary stage of the development of metered water.

The following sections discuss: 1) The procedure to determine water value; 2) the capitalization factor and

tables of water value determination statistics and metered water rates for use in the formula for obtaining water value; 3) the formula; and 4) an application of the formula.

Procedure to Determine Water Value

Step 1.—Total State use for a year is computed in acre-inches, by multiplying per-capita use by population and dividing by gallons-per-acre-inch factor.

Step 2.—Percent of runoff on the protected area is computed by dividing the Statewide runoff into protected area runoff.

Step 3.—The acre-inches of runoff used from protected area is computed by multiplying the total use by percent from protected area (Step 1 x Step 2).

Step 4.—The total value of the water from the protected area is computed by applying available runoff from protected area, times price, times discount factor, times capitalization factor.

Capitalization Factor

The capitalization factor is the present value of an annual series of $1 payments for a specified number of years. In studying the experience of the USDA Forest Service, it is found that this annual factor is generally accepted and applied at 5 percent for 40 years to determine value and worth of installations, structures, and long-term improvements. The formula used to express this is:

$$CF = AC \frac{[(1+i)^n - 1]}{i(1+i)^n}$$

CF = Capitalization factor

AC = Annual cost (payment)

i = Interest rate

n = Years

Thus, on the basis of 5 percent at 40 years, the capitalization factor used in this study is $17.15.

Formula for Obtaining Water Value

To arrive at a formula for obtaining the value of water, the steps below should be followed:

1 $\frac{C \times D \times I}{J}$ = Water used (million acre inches).

2 $\frac{A \times F}{B \times E}$ = Percent of runoff on protected area.

3 Result of Step 1 x Result of Step 2 = Acre inches used from protected area.

4 Result of Step 3 x G x K x H = Value of water from the protected area.

The formula can then be expressed as:

$$\frac{C \times D \times I}{J} \times \frac{A \times F}{B \times E} \times G \times K \times H = \text{Water Value}$$

A = Runoff from protected area*
B = Runoff from entire State*
C = Water use (g.p.d. per capita)
D = Population (million)
E = Area of State (million acres)
F = Area protected
G = Cost of metered water (per acre inch)
H = Capitalization factor (17.15)
I = Days per year
J = 27,154 gallons per-acre inch
K = Discount factor (.10)
(*Unpublished preliminary statistics of USDA Forest Service)

See sample of application following.

Sample

Water — State B

1. $\frac{\text{Gallons/day/per capita} \times \text{population (millions)} \times \text{Days/year}}{\text{Gals./Acre inch}}$ = Acre inches

$$\frac{2300 \times 18{,}400{,}000 \times 365}{27{,}154} = 569{,}181{,}000 \text{ Acre inches}$$

2. Runoff from protected area x Area protected = Percent runoff from protected area

$$\frac{17.9 \times 57.24 \text{ Mill. Ac.}}{11.6 \times 100.2 \text{ Mill. Ac.}} = 88 \text{ percent}$$

Runoff from entire State x Area of entire State

3. Step 1 x Step 2 = Acre inches used from protected area

   569,181,000 x 88% = 501,858,000 Acre inches

4. Step 3 x Cost of metered water x Discount factor

   x Capitalization factor = Value of water from protected land

   501,858,000 x $6.70 x .10 x 17.15 = $5,766,599,349

   Total Value of Water From Protected Land = $5,766,599,349

Table 4.—Statistics used in water value determinations[1]

State	Yearly Run-off prot. area	Yearly Run-off tot. State	Population	Prot. area	Tot. State	Use per capita
	Inches	*Inches*	*Millions*	*Million acres*	*Million acres*	*G.p.d.*
Alabama	20.0	19.5	3.48	21.65	32.68	1,900
Alaska	28.0	28.0	.27	259.97	365.48	540
Arizona	2.2	2.0	1.58	33.53	72.69	4,000
Arkansas	12.1	11.3	1.94	19.07	33.60	1,100
California	17.9	11.6	18.40	57.24	100.21	2,300
Colorado	10.1	7.1	1.99	33.15	66.49	6,000
Connecticut	22.1	20.0	2.83	1.99	3.13	790
Delaware	16.2	16.0	.50	.41	1.27	2,300
Florida	17.5	17.7	5.80	18.45	34.72	2,300
Georgia	19.0	18.2	4.39	25.24	37.29	730
Hawaii	45.0	44.0	.71	2.10	4.11	2,800
Idaho	10.5	9.0	.69	43.75	52.93	23,000
Illinois	10.6	10.0	10.64	3.86	35.79	1,600
Indiana	14.5	12.0	4.89	4.15	23.16	2,000
Iowa	9.2	5.4	2.76	2.66	35.86	770
Kansas	4.0	2.0	2.25	10.44	52.51	1,600
Kentucky	18.5	17.0	3.17	11.55	25.51	1,000
Louisiana	18.0	17.2	3.56	12.94	28.87	1,900
Maine	20.3	19.3	.99	17.43	19.85	800
Maryland	16.7	16.5	3.53	2.88	6.35	1,200
Massachusetts	19.9	19.5	5.36	3.27	5.03	620
Michigan	13.1	12.5	8.32	20.50	36.49	1,100
Minnesota	7.2	4.0	3.56	21.38	51.21	860
Mississippi	20.0	19.3	2.31	16.79	30.22	550
Missouri	10.1	8.3	4.49	12.06	44.25	590
Montana	8.1	6.0	.70	40.93	93.27	9,500
Nebraska	1.7	1.5	1.46	5.74	49.03	3,100
Nevada	2.1	1.9	.47	57.16	70.26	4,800
New Hampshire	21.3	18.9	.67	5.02	5.77	720
New Jersey	22.0	21.2	6.78	2.13	4.81	950
New Mexico	2.7	2.0	1.01	40.58	77.77	3,000
New York	24.1	19.1	18.11	12.66	30.68	890
North Carolina	19.0	18.8	4.94	19.36	31.40	800
North Dakota	2.0	1.7	.65	1.60	44.45	500
Ohio	12.5	12.5	10.20	4.13	26.22	1,500
Oklahoma	9.0	4.3	2.45	4.70	44.09	480
Oregon	28.8	18.3	1.94	45.18	61.60	3,400
Pennsylvania	21.0	19.9	11.59	17.04	28.80	1,300
Rhode Island	20.5	20.0	.89	.43	.68	500
South Carolina	19.0	18.6	2.55	12.70	19.37	690
South Dakota	2.4	1.5	.69	3.71	48.88	630
Tennessee	21.5	21.0	3.85	13.27	26.73	1,200
Texas	8.0	3.3	10.59	18.64	168.22	2,300
Utah	5.2	4.5	.99	44.76	52.70	4,100
Vermont	22.8	20.5	.40	4.32	5.94	320
Virginia	17.0	16.5	4.42	16.17	25.50	1,200
Washington	39.2	24.0	2.97	25.78	42.69	2,100
West Virginia	21.5	19.9	1.81	11.47	15.41	2,700
Wisconsin	12.5	12.0	4.09	17.03	35.01	1,200
Wyoming	8.8	5.8	.33	36.15	62.34	15,000

Table 5.—Average metered water rates by States[1]

State	Average rates per 100,000 cu. ft.[2]	Average rates per acre inch[3]	State	Average rates per 100,000 cu. ft.[2]	Average rates per acre inch[3]
Alabama	$148.13	$6.73	Montana	$151.03	$6.87
Alaska	--	--	Nebraska	86.78	3.94
Arizona	125.29	5.69	New Hampshire & Vermont	115.70	5.26
Arkansas	172.02	7.82	New Jersey	179.97	8.18
California	147.35	6.70	New Mexico	149.82	6.81
Colorado	181.55	8.25	New York	174.40	7.93
Connecticut	162.91	7.41	North Carolina	162.79	7.40
Delaware	--	--	North Dakota	236.16	10.73
Dist. of Columbia	120.45	5.47	Ohio	182.38	8.29
Florida	185.80	8.45	Oklahoma	191.50	8.70
Georgia	154.92	7.04	Oregon	108.88	4.95
Hawaii	191.17	8.69	Pennsylvania	169.50	7.70
Idaho	104.96	4.77	Rhode Island	161.83	7.36
Illinois	217.55	9.89	South Carolina	160.51	7.30
Indiana	178.46	8.11	South Dakota	162.62	7.39
Iowa	156.11	7.10	Tennessee	163.02	7.41
Kansas	183.12	8.32	Texas	185.30	8.42
Kentucky	181.74	8.26	Utah	139.30	6.33
Louisiana	157.62	7.16	Vermont (see New Hampshire)	--	--
Maine	125.29	5.70	Virginia	159.20	7.24
Maryland	143.29	6.51	Washington	104.06	4.73
Massachusetts	172.89	7.86	West Virginia	153.46	6.98
Michigan	130.53	5.93	Wisconsin	117.93	5.36
Minnesota	162.82	7.40	Wyoming	152.76	6.94
Mississippi	134.33	6.11	Puerto Rico	182.21	8.28
Missouri	206.17	9.37			

[1] Source: American Water Works Association, Inc., 2 Park Ave., New York, N.Y. 10016. [2] Actual rates by city are given in the appendix, p. 32. [3] The 1960 rates were increased by 25 percent, upon advice of officials of A.W.W.A. This adjustment was not applied to the average rates per 100,000 cubic feet.

For further reference:

Annual Runoff in the U.S.A., U.S. Geological Survey, Washington, D.C. 20242

Basic Statistics of Soil & Water Conservation Needs, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250

Development and Management of Water Resources, Public Land Law Review Commission, Washington, D.C. 20006

Estimated Use of Water in the U.S., U.S. Geological Survey, Washington, D.C. 20242

National Water Resources, Water Resources Council, Washington, D.C. 20005

Our Growing Water Problems, National Wildlife Federation, Washington, D.C. 20036

Science of Saving Water & Soil, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250. 1968.

Soil and Water Conservation Needs—A National Inventory, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250. 1965.

Water Rates Manual, American Water Works Assn., Inc., 2 Park Ave., New York, N.Y. 10016

Water—1955 Yearbook of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250. 1955.

RECREATION

The nationwide expenditures for outdoor recreation facilities are huge capital investments. Outdoor recreation is considered an "industry" and is rated near the top income producer in many States. Most economic surveys of tourism and recreation are based on tourist spending. There is little uniformity between States on items included. In contrast, the method adopted to measure the recreation value in this study is developed on the monetary unit value of the recreational experience—the recreation day[1] approach. This is based on the admission fee people pay or are willing to pay for a day's recreational activity: the price of the theater ticket to see the performance but excluding the parking fee, transportation, or other expenditures.

The resource manager is involved with the outdoor recreation impact in every phase of his work. Each management decision must consider natural beauty, esthetics, landscape, and effects on the environment. Outdoor recreation is a resource which places demands on wildland management equal to or exceeding those on timber, water, forage, or wildlife in many parts of the country. The nationwide expenditures for provision of physical facilities and maintenance of natural settings for recreation users are a huge capital investment. The resource manager is protecting this huge recreation resource. How is its value measured?

In the Economic Development Administration (Department of Commerce) study on *Tourism and Recreation,* a whole chapter is devoted to indirect methods of measuring tourist spending. Some of the difficulties found when these methods are used to determine the value of the recreation resource are stated in the following quote from a report by Russell Ackoff:

"There is anything but common agreement among scientists and philosophers of science as to just what measurement is and how it should be performed. Measurement, perhaps more than any other research activity, has been the principal stimulus of progress in both pure and applied science." The report continues, "In the measurement of tourist spending and its impact on the economy of a State or region, these observations are particularly true. The methods in use today for measuring recreation values represent a large measure of guesswork. They are frequently stimulated by the desire of a State Tourist Development Agency to maximize its own budget, by presenting as large a figure for tourist expenditures as possible to the State legislature."

The approach to recreation value in current literature is focused on the expenditures by tourists, hunters, fishermen, and vacationers. Generally, it reflects income as gross national product, gross local product, or total dollars spent on tourism in the community or States. Some expenditures that are included are found to have been made a considerable distance from the community, while double counting of dollars is not uncommon. This system is without uniform requirements, making comparison between States very difficult.

As noted previously, the method adopted for use in this study is based on the value of a recreation day. This system has several advantages:

1. Double counting of dollars is avoided.
2. The value obtained has a closer parallel to the value of timber in the form of "stumpage," rather than value of logs at mill or lumber in the yard.
3. The value of annual "income" may be capitalized to get the total worth, as is done with grazing, special uses, and other annual charges or fees.
4. A capital investment is reflected in the fees, or the recreation day.

The guidelines for this approach are found in Senate Document No. 97, 86th Congress, Supplement No. 1 entitled *"Evaluation Standards for Primary Outdoor Recreation Benefits, June 4, 1964."*

Section V of Supplement No. 1 provides a schedule of monetary unit values for tangible benefits as follows:

Schedule of Monetary Unit Values

A single unit value will be assigned per recreation day, regardless of whether the user engages in one activity or several. The unit value, however, may reflect both the quality of activity and the degree to which opportunities are provided to engage in a number of activities.

A *general* recreation day is one involving primarily those activities attractive to the majority of outdoor recreationists and which generally require the development and maintenance of convenient access and adequate facilities. The unit value range[2] is $0.70-$2.10.

A *specialized* recreation day is one involving those activities for which opportunities, in general, are limited, intensity of use is low, and often may involve a large personal expense by the user. The unit value range is $2.50-$7.50.

The schedule of monetary unit values is designed to give the qualified technician ample room for judgment.

The following sections present: 1) A table which provides a suggested grouping of general and specialized recreational activities and their monetary unit values; 2) the procedure to determine recreation value; and 3) an application of the procedure.

Procedure to Determine Recreation Value

Step 1.—Determine number of recreation days[3] by activities for protected area. (National Forests and State

[1] *Recreation or Visitor Day* — Recreation use which aggregates 12 person-hours. May entail 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of individual or group use, either continuous or intermittent. (Circular No. 6, Recreation Advisory Council, Washington, D. C., Oct. 20, 1965).

[2] Increased 25 percent to reflect cost of living rise since 1964 data.

[3] Do not include hunting and fishing. These are included under the Wildlife Section on page 19.

and National Parks, State travel and tourist agencies have good records that will be helpful to estimate recreation use in the protected area. A State master plan for recreation, if available, may be a good source.)

Step 2.—Apply the monetary unit value for each activity.

Step 3.—Add total value of all activities.

Step 4.—Apply capitalization factor of $17.15 (see p. 10) to obtain the value of recreation in the State. See sample of application following.

Sample

Recreation	State C	Recreation	State C
Recreation Use in 1968 for State C:		Interpretive	741,720 users
Family Cabins	84,113 users	Winter Sports	159,597 users
Tent Camping	1,081,496 users	Transients	8,187,501 users
Group Camping	137,727 users		
Picnicking	4,630,405 users		
Swimming	3,274,932 users		
Boating	612,052 users		

1. Determine number of recreation days by activities
2. Apply unit value per activity
3. Add total value of all activities
4. Apply capitalization factor

Value of recreational use for State "C" based on 1968 data

Type Use	No. users	Use days per type	Use days	Rate	Total value
Family Cabins	84,113	2	168,226	$1.40	$235,516
Tent Camping	1,081,496	2	2,162,992	1.40	3,028,188
Group Camping	137,727	2	275,454	5.00	1,377,270
Picnicking	4,630,405	1/3	1,543,468	1.40	2,160,855
Swimming	3,274,932	1/3	1,091,644	1.40	1,528,301
Boating	612,052	1/2	306,026	1.40	428,436
Interpretive	741,720	1/3	247,240	1.40	346,136
Winter Sports	159,597	1/2	79,798	5.00	398,990
Transients	8,187,501	1/6	1,364,583	1.40	1,910,416
TOTAL					$11,414,108

Computation:
$11,414,108 x 17.15 = $195,751,952 of capitalized recreational value in State C

TABLE 6.—Grouping of recreational activities (Hunting and fishing not included)

General *(Unit value range - $.70 - $2.10[1] per recreation day)*

- Auto Driving for Pleasure
- Boating
- Camping
- Canoeing
- Forest Environment
- Gathering Forest Products
- Hiking
- Ice Skating
- Nature Study, Walks, Bird Watching
- Outdoor Games and Sports
- Picnicking
- Scooter and Motor Scooter
- Sightseeing
- Sledding
- Swimming (bathing)
- Tobogganing
- Viewing Scenery
- Walking for Pleasure

Specialized *(Unit value range - $2.50 - $7.50[1] per recreation day)*

- Horseback Riding
- Ice Boating
- Interpretive Programs
- Mountain Climbing
- Nature Photography
- Organization Camp Use
- Outdoor Concerts and Plays
- Power Boating - Water Skiing
- Recreation Residence Use (Summer House)
- Resort Use
- Sailing
- Scuba Diving
- Skiing
- Snowmobiling
- White Water Canoeing
- Wilderness Use

[1] Unless more specific guidelines are available from in-State sources, it is suggested that the average of the range of values be used.

For further reference:

Appraisal of Recreation Potentials, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250

Economics of Outdoor Recreation, by Marion Clawson, Resources for the Future, Inc., Washington, D.C. 20036. 1966.

Evaluation Standards for Primary Outdoor Recreation Benefits, Ad Hoc Water Resources Council, Washington, D.C. 20005. 1964.

Forest Recreation Industry Survey, American Forest Institute, Washington, D.C. 20006

Land—1958 Yearbook of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250. 1958.

Outdoor Recreation for America, Bureau of Outdoor Recreation, U.S. Department of Interior, Washington, D.C. 20240

Outdoor Recreation Trends, Bureau of Outdoor Recreation, U.S. Department of Interior, Washington, D.C. 20240

Recreation Land Price Escalation, Bureau of Outdoor Recreation, U.S. Department of Interior, Washington, D.C. 20240

Rural Recreation for Profit, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250. 1963.

Scenery Classification, University of Vermont, Burlington, Vt. 05401

Study of Outdoor Recreation on Public Lands, Public Land Law Review Commission, Washington, D.C. 20006

Rural Recreation Enterprises for Profit, U.S. Department of Agriculture, Washington, D.C. 20250. 1963.

Tourism and Recreation, Economic Development Admin., U.S. Department of Commerce, Washington, D.C. 20230

Values of Hunting and Fishing in Arizona, University of Arizona, Tucson, Ariz. 85721.

The wildlife resource is commonly measured by placing a value on the hunter and fisherman day use. This system is used by the Fish and Wildlife Service[4], the States, and universities in conducting economic surveys of wildlife; however, the value is based upon total expenditures by hunters and fishermen. For the same reasons given in the recreation section, the method used in this study is based on a monetary unit value applied to a hunting or fishing day experience. Indirect expenditures are avoided.

Though fishing and hunting activities are found in recreation statistics[5], it is important to treat this use apart from recreation to determine a wildlife value. The hunter and the fisherman pursue their activities with the definite purpose of acquiring fish or game. It is a *consumptive* activity. The major objective is the challenge of the sport, a trophy, or meat. Of course there are many recreational side benefits. But, the wildlife resource is administratively organized and financed separately in the States and in the Federal government.

Nonconsumptive wildlife activities, such as bird-watching and photography, are *not* included in the wildlife values. These activities are better described in terms of recreational value, like tree identification, wildflower and nature study, which are not considered in timber and forage values.

The following sections present: 1) A schedule of monetary unit values for wildlife activities; 2) a procedure to determine wildlife values; and 3) an application of the procedure.

Procedure to Determine Wildlife Values

Step 1.—Obtain number of fishing and hunting days spent in protected area. (Fish & Game reports are a good source. Number of fishing and hunting license holders, resident and nonresident, plus estimate of exempt and unlicensed use may be used when average number of days by types of hunting and fishing is applied.)

Step 2.—Classify fishing and hunting days (Step 1, above) by activities in schedule of monetary unit values.

Step 3.—Apply value rates from schedule of monetary unit values.

Step 4.—Total all values.

Step 5.—Apply the capitalization factor of 17.15.

See sample of application following.

[4] National Survey of Fishing and Hunting—Fish & Wildlife Service 1965.

[5] Hunting and fishing activities are generally included in the reports on recreation use. It is necessary to deduct the hunting and fishing use from the recreation data to avoid duplication when recreation value is determined.

SAMPLE

Wildlife		State D
Hunting		
1,000,000 hunters		
14 days per hunter per year		
5 days big game @ $4.60/day		
9 days small game @ $2.20/day		
1,000,000 x $4.60 x 5 days	=	$23,000,000
1,000,000 x $2.20 x 9 days	=	19,800,000
Fishing		
1,250,000 fishermen		
12 days per fisherman per year		
$5.00 per day		
1,250,000 fishermen x 12 days p/y x $5.00/day	=	75,000,000
		$117,800,000
$117,800,000 x 17.15	=	$2,020,270,000
Total Value of Wildlife	=	$2,020,270,000

TABLE 7.—Schedule of monetary unit values for wildlife[1]

Activity	*Range of unit value of hunting and fishing*[2]
Hunting small game (mammals)	$0.70—$2.50
Hunting small game (birds)	$1.25—$3.75
Hunting waterfowl	$1.75—$5.60
Hunting big game (deer & antelope)	$1.75—$5.60
Hunting other types of big game	$2.50—$7.50
Cold water fishing	$2.50—$7.50
Warm water fishing	$1.25—$3.75

[1] Based on *Evaluation Standards for Primary Outdoor Recreation Benefits,* Supplement No. 1, Ad. Hoc. Water Resources Council, Washington, D.C., June 4, 1964; and judgmental values by Fish and Wildlife Service on different types of hunting and a 25% cost of living increase applied to unit values.

[2] Unless more specific guidelines are available from in-State sources, it is suggested that the average of the range of values be used.

For further reference:

Evaluation of Wildlife in Washington, Washington State University, Pullman, Wash. 99163

People-Wildlife, Department of Game, Olympia, Wash. 98501

Wildlife Resource Survey, Department of Game, Olympia, Wash. 98501

Value of North Carolina Game and Fish, North Carolina Wildlife Resources Commission, Raleigh, N.C. 27602

National Survey of Fishing and Hunting, Fish & Wildlife Service, U.S. Department of Interior, Washington, D.C. 20240. 1965

FORAGE

Forage is an important resource in many States, especially in the West. Much of the protected area in the East has no grazing or forage value. The method used to determine forage value is based upon the grazing fees charged per animal unit month (AUM).

The forage resource was considered from several viewpoints.

If complete loss of the range occurs, the cost of alternate feeding for the time required to restore the range (2 years) may be assumed to be the value of the forage resource. Range people estimated a requirement of 600-750 lbs. of hay per AUM or approximately $25.00. To this would be added the intrusion onto winter range, special feeding equipment, and the loss of any feed production area which may be needed to support the herd.

Another approach which may represent forage value is the sale of all or part of the herd when the range is destroyed. The determination of the total loss of going out of the livestock business for the duration is quite complicated. Substitution of alternative agricultural production, keeping the experienced labor force occupied, and other directly related elements influence the value involved.

Neither of these approaches are recommended since they are predicated on loss. The method where value is based on annual fees provides a simple direct approach and is used in this study.

Sufficient basic data is available to permit quite accurate determination of forage value in those States where grazing is important. Each State Forester should determine the acreage available for grazing in the protected area of his State. Grazing fees by States from a recent survey conducted by USDA's Economic Research Service are listed in the table on p. 22. The grazing capacity will have to be determined in cooperation with the Extension Service or Soil Conservation Service in each State to complete the computation of total forage values. Since this method of computing value is based on fees per animal unit month paid each year, the capitalization factor is applied (see p. 10).

The following sections present: 1) A table of rates for pasturing cattle on private lands; 2) the procedure for determining forage value; 3) a formula for obtaining this value; and 4) an application of the formula.

Procedure to Determine Forage Value

Step 1.—Determine the acreage available for grazing in the protected area.

Step 2.—Divide acreage by grazing capacity.

Step 3.—Multiply by average rate per AUM.

Step 4.—Multiply by capitalization factor of 17.15.

Formula For Obtaining Forage Value

$$\frac{A}{B} \times C \times D = \text{Forage value}$$

A = Acreage available for grazing in the protected area.
B = Grazing capacity (acres required to produce 1 AUM—data from Extension Service or Soil Conservation Service)
C = Rate or fee per AUM.
D = Capitalization factor.
See sample of application following.

Sample

Forage		State E
Available acreage	=	15,142,000
Grazing capacity	=	5.96 AC/AUM
Fee/AUM	=	$3.45

$$\frac{\text{Acreage available for grazing in the protected area}}{\text{Grazing capacity (AUM)}} \times \text{Fee/AUM} \times \text{Capitalization factor}$$

$$\frac{15,142,000}{5.96} \times \$3.45 \times 17.15 = \$150,321,191$$

Total Value of Forage State E = $150,321,191

Table 8.—Average rate per animal unit per month for pasturing cattle on privately owned lands

State	1968 Rates	State	1968 Rates
Alabama	$2.10	Montana	$3.66
Alaska	--	Nebraska	4.50
Arizona	3.16	Nevada	4.43
Arkansas	2.01	New Hampshire	2.50
California	3.71	New Jersey	4.66
Colorado	4.03	New Mexico	3.43
Connecticut	2.83	New York	2.34
Delaware	3.30	North Carolina	2.79
Florida	1.72	North Dakota	2.26
Georgia	2.76	Ohio	2.27
Hawaii	--	Oklahoma	3.06
Idaho	3.48	Oregon	3.64
Illinois	2.71	Pennsylvania	3.09
Indiana	2.45	Rhode Island	3.00
Iowa	2.73	South Carolina	2.55
Kansas	4.19	South Dakota	3.72
Kentucky	2.61	Tennessee	2.22
Louisiana	1.13	Texas	2.71
Maine	2.27	Utah	3.53
Maryland	2.91	Vermont	1.97
Massachusetts	2.25	Virginia	2.63
Michigan	2.50	Washington	3.63
Minnesota	2.73	West Virginia	1.90
Mississippi	1.78	Wisconsin	2.98
Missouri	2.83	Wyoming	3.95

For further reference:

Agricultural Statistics, 1968. U.S. Department of Agriculture, Washington, D.C. 20250. 1968.

Effects of Changes in Grazing Fees and Permitted Use of Public Rangelands on Incomes of Western Livestock Ranches, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250

Factbook of U.S. Agriculture, U.S. Department of Agriculture, Washington, D.C. 1967.

Forestry Handbook, Society of American Foresters, Washington, D.C. 20036. 1955.

Grass—1948 Yearbook of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250. 1948.

Land—1958 Yearbook of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250. 1958.

Land and Water Resources: A Policy Guide, U.S. Department of Agriculture, Washington, D.C. 20250. 1963.

Major Uses of Land and Water in the U.S., U.S. Department of Agriculture, Washington, D.C. 1962.

REAL AND PERSONAL PROPERTY

Real improvements and investments related to water, recreation, wildlife, and forage are included in the methods used to determine the value of these resources. All other real improvements and investments within the protected area have not been determined. The data available are lacking on a national basis, and present too great a gap to be usable for protected area purposes.

The 1,134,224,000 acres of the protected area in the United States embraces tremendous private and public capital investments and equipment. Improvements and investments on recreation, wildlife, and forage resources damageable by fire are values protected. The improvements and investments involving homes, farm structures, industries, railroads, highways, power and telephone lines, etc., are additional values protected. Some nationwide improvement and investment figures are as follows:

	Billion dollars
Farmland and improvements	159.9
Farm buildings	28.1
Farm implements and equipment	18.5
Manufacturing industries (structures & equip.)	94.5
Manufacturing industries (structures only)	45.5

	Miles
Railroad mileage	376,290
Rural roads	3,145,000
Oil pipelands	155,053
Telephone and telegraph lines	382,757,000

No source material has been found that identifies these values on a State-by-State basis. This is proposed as an interim procedure pending the development of a more precise methodology. The table on p. 26 shows the total value of farm land plus improvements by States. If the State Forester is unable to obtain more accurate data from local sources, it is recommended that he estimate the percentage of rural land and improvements that would be threatened by uncontrolled wildfires within his protected area. This percentage should be applied to the value listed in the table. Twenty-five percent of this combined value of land and improvements is suggested as the real and personal property value that is protected. States using a different approach should report the source of their data.

The following sections present: 1) A table of land and farm values for use in the procedure to determine real and personal property values; 2) the procedure; and 3) application of the procedure.

Procedure to Determine Real and Personal Property Value

Step 1. – Estimate percentage of rural land and improvements threatened.

Step 2. – Apply percentage to value in table.

Step 3. – Multiply step 2 by 25 percent = value of real and personal property.

Sample

Real and Personal Property — State F

1. 50 percent of rural land and improvements threatened.

2. 3,181,660,608 x .50 = $1,590,830,304

3. $1,590,830,304 x .25 = $ 397,707,576

Table 9.—Value of land and farms (1964 Census)

State	Total Value	State	Total Value
Alabama	$1,901,676,560	Nebraska	5,232,078,684
Alaska	18,011,300	Nevada	393,332,016
Arizona	2,140,965,873	New Hampshire	118,068,496
Arkansas	2,934,973,132	New Jersey	781,975,167
California	17,354,881,800	New Mexico	1,662,698,652
Colorado	2,687,273,034	New York	2,181,328,470
Connecticut	409,159,172	North Carolina	3,622,353,284
Delaware	235,202,643	North Dakota	2,854,464,200
Florida	4,421,226,726	Ohio	5,221,285,113
Georgia	2,430,535,730	Oklahoma	4,366,383,912
Hawaii	481,224,704	Oregon	2,348,803,803
Idaho	2,022,227,658	Pennsylvania	2,478,953,896
Illinois	10,744,502,868	Rhode Island	50,633,000
Indiana	5,581,894,890	South Carolina	1,403,275,104
Iowa	9,180,809,586	South Dakota	2,813,935,345
Kansas	6,137,738,680	Tennessee	2,736,844,014
Kentucky	2,958,099,930	Texas	15,948,533,160
Louisiana	2,413,436,376	Utah	910,034,973
Maine	257,229,625	Vermont	274,941,051
Maryland	1,349,379,240	Virginia	2,215,520,488
Massachusetts	348,762,348	Washington	2,930,590,496
Michigan	3,181,660,608	West Virginia	478,984,528
Minnesota	5,125,194,225	Wisconsin	3,180,110,240
Mississippi	2,654,527,402	Wyoming	1,042,578,490
Missouri	4,927,834,065	Total	159,936,517,177
Montana	2,790,382,420		

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LIFE AND HEALTH

We recognize the fact that annually there are injuries and loss of life in connection with the development, protection, and use of these forest related resources. Actually, forest fires on the National Forests take an average of 12 lives of firefighters each year, while injuries requiring medical treatment may be as high as 3,000. Expenditures reported by the Forest Service for medical treatment, compensation, court costs, investigations, etc., total several million dollars a year. Statistics for State and private lands are meager, but there are indications of an average annual loss of 17 firefighter lives, with accompanying injury cases.

We can assume that there are many more deaths and injuries of private individuals associated with protection of home and property from wildfire.

Causes of injury and death on the protected area are certainly not limited to fire, although this is perhaps more dramatic and shocking to the public. Indeed, accidents occur in all resource activities from the administration of wildlife activities, through recreation management to forest cultural work. There is, however, insufficient published information to provide national or State statistics, as well as lack of satisfactory measurement of life and health value.

Credit line: Photo courtesy California Division of Forestry, Riverside, Calif.

AIR QUALITY

Airborne contaminants resulting from forest fires not only pollute the atmosphere but have resulted annually in stoppages or interruption of our transportation systems, and have otherwise interfered with the lives of many people. The Department of Health, Education, and Welfare is working on the problem, and findings are expected in the near future.

Airborne chemical contaminants are produced annually throughout our Nation by wildfires as well as prescribed burning. It is estimated that 500,000 tons of hydrocarbons contaminate the atmosphere annually. In addition to the disagreeable effect of smoke pollution on people, there are continual interruptions to our normal way of life.

Examples: (1) In 1965, the launching of a Gemini Missile from Cape Kennedy was delayed several days because of atmospheric conditions caused by forest fires in the Everglades. (2) In 1967, large forest fires caused a heavy pall of smoke to prevail over central Alaska for several weeks causing discomfort, stoppage of air traffic, and general misery for tourists. (3) Heavy smoke from the Sundance fire in Idaho in 1967 covered the sky for days as far north as Winnipeg, Manitoba. (4) During the past 5 years, many airports, railroads, and highways have been closed or traffic interrupted due to forest fire smoke. Although wildfires have been responsible for the bulk of these problems, prescribed burning has also added to the contamination.

Inquiries to officials of Department of Health, Education and Welfare and the Department of Commerce failed to provide tangible data. The Division of Forest Fire and Atmospheric Sciences Research of the USDA Forest Service has studied this problem and though unable to give us information on values, has informed us that HEW has intensified their research. Any attempt to assign values at this time could cause public misunderstanding of research efforts by agencies involved.

Credit line: Photo courtesy Gannett Publishing Company, Maine.

APPENDIX

Table 10.—Metered water rates by city and State[1]

State	City	Metered rates per 100,000 cu. ft.
		Dollars
Alabama		
	Albertville	--
	Alexander	153.40
	Andalusia	135.50
	Anniston	101.40
	Bessemer	162.00
	Birmingham	161.65
	Decatur	124.30
	Dothan	161.67
	Florence	144.65
	Gadsden	87.30
	Huntsville	127.12
	Jasper	165.30
	Mobile	266.25
	Montgomery	131.88
	Prichard	138.62
	Selma	120.00
	Sheffield	204.80
	Talladega	132.85
	Troy	134.65
	Tuscaloosa	161.05
Alaska		
Arizona		
	Mesa	107.18
	Phoenix	127.10
	Tucson	141.27
	Yuma	125.60
Arkansas		
	Benton	93.30
	Camden	162.55
	Eldorado	149.64
	Forrest City	149.90
	Fort Smith	129.99
	Helena	148.95
	Hot Springs	185.00
	Jonesboro	118.90
	Springdale	354.03
	Little Rock	227.96
California		
	Alameda County Wat. District	238.17
	Alhambra	118.00
	Anaheim	130.95
	Arcadia	122.78
	Beverly Hills	118.00
	Burbank	117.30
	Burlingame	242.00
	Campbell	138.25
	Chula Vista	277.20
	Compton	80.50
	Coronado	331.10
	E. Bay Mun. Util. Dist.	155.64
	Hanford	107.36
	Fullerton	109.70
	East Palo Alto	--
	El Centro	101.75
	Fresno	66.61
	Glendale	155.00
	Hawthorne	167.60
	Helix Irrigation Dist.	95.40
California—Continued		
	Huntington Park	150.00
	Inglewood	151.50
	Laguna Beach	--
	Lakewood	142.63
	Lompoc	--
	Long Beach	153.50
	Los Angeles	141.16
	Merced	88.45
	Modesto	78.15
	Monrovia	104.60
	Monterey	282.10
	Oxnard	173.80
	Palo Alto	241.20
	Paramount County Water Dist.	60.84
	Pasadena	165.50
	Pittsburg	193.40
	Pomona	70.83
	Redwood	251.97
	Sacramento	120.00
	San Bernardino	116.50
	San Diego	249.68
	San Gabriel	100.25
	San Marino	128.25
	San Francisco	205.36
	Santa Ana	105.98
	Santa Barbara	175.00
	Santa Cruz	136.55
	Santa Monica	139.30
	Santa Paula	115.30
	Santa Rosa	190.10
	South Gate	73.20
	Tracy	77.00
	Tulare	77.00
	Ventura	186.88
	Vista Irrigation Dist.	--
	Whittier	143.00
Colorado		
	Aurora	296.00
	Boulder	116.67
	Colorado Springs	231.05
	Denver	138.50
	Englewood	153.90
	Fort Collins	100.80
	Grand Junction	122.31
	Greeley	108.00
	Sterling	--
	South Adams County	366.70
Connecticut		
	Ansonia	198.03
	Bristol	246.00
	Hartford	226.20
	Manchester	138.00
	Middletown	35.48
	New Haven	271.37
	New London	124.96
	Norwich	137.32
	Stamford	149.94
	Torrington	156.12
	Wallingford	108.60

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
		Dollars
Delaware		
District of Columbia		
	Washington	120.45
Florida		
	Cocoa	227.75
	Deland	151.55
	Fort Lauderdale	174.25
	Hialeah	189.00
	Hollywood	234.68
	Key West	--
	Lake Worth	216.00
	Lakeland	100.29
	Melbourne	176.00
	Miami	120.90
	Miami Beach	187.50
	North Miami	233.96
	North Miami Beach	255.64
	Ocala	171.80
	Opalocka	--
	Orlando	90.60
	Pinellas Co. Wat. Sys.	256.20
	Plant City	121.39
	Pompano Beach	158.37
	Saint Petersburg	274.08
	Tampa	165.24
	West Palm Beach	210.75
Georgia		
	Albany	117.00
	Atlanta	166.61
	Bainbridge	106.80
	Cobb Co. Wat. Auth.	220.50
	DeKalb Co. Wat. Sys.	139.50
	Elberton	--
	Newnan	181.77
	Savannah	176.20
	Waycross	130.95
Hawaii		
	Hilo	242.00
	Honolulu	132.00
	Kahului Maui	199.50
Idaho		
	Boise	129.50
	Caldwell	65.75
	Coeur D' Alene	76.60
	Idaho Falls	--
	Lewiston	99.00
	Moscow	184.03
	Pocatello	53.94
	Nampa	125.92
Illinois		
	Alton	176.05
	Arlington Heights	152.50
	Bloomington	224.60
	Cairo	251.87
	Calumet City	344.03
	Carbondale	261.00
	Champaign-Urbana	163.60
Illinois—Continued		
	Chicago	120.00
	Decatur	162.50
	Dekalb	150.78
	Des Plaines	--
	East Moline	192.87
	East St. Louis	374.30
	Elgin	209.41
	Evanston	152.00
	Freeport	131.20
	Glenview	300.00
	Joliet	--
	Kankakee	229.82
	Kewanee	147.32
	Lake Forest	320.00
	Macomb	170.30
	Marion	178.96
	Moline	226.27
	Mundelein	289.35
	Murphysboro	159.67
	Northlake	--
	Oak Lawn	375.60
	Oak Park	337.50
	Peoria	180.68
	Quincy	151.59
	Rock Island	155.33
	Rockford	332.53
	Springfield	103.50
	Sterling	273.19
	Streator	314.93
	Waukegan	91.00
	Winnetka	210.00
Indiana		
	Elkhart	88.81
	Elwood	174.76
	Fort Wayne	174.95
	Gary	183.59
	Griffith	--
	Highland	197.00
	Indianapolis	211.28
	Kokomo	295.40
	Lawrence	123.84
	Logansport	162.65
	Marion	104.76
	Michigan City	150.25
	Muncie	191.00
	Munster	256.40
	Richmond	147.95
	Terre Haute	212.80
	Washington	190.50
	West Lafayette	167.90
Iowa		
	Ames	327.40
	Boone	91.40
	Burlington	162.25
	Cedar Falls	106.03
	Cedar Rapids	202.60
	Charles City	92.70
	Clinton	260.48
	Council Bluffs	251.40
	Davenport	167.20

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
		Dollars
Iowa—Continued		
	Des Moines	150.80
	Dubuque	176.52
	Fort Dodge	111.61
	Iowa City	156.06
	Keokuk	125.43
	Marion	188.70
	Marshalltown	139.40
	Mason City	117.00
	Muscatine	53.10
	Newton	137.62
	Ottoumwa	220.30
	Sioux City	110.40
	Waterloo	74.34
	West Des Moines	167.90
Kansas		
	Arkansas	109.62
	Atchison	267.05
	Chanute	151.00
	Coffeyville	197.70
	Fort Scott	209.50
	Great Bend	--
	Independence	157.65
	Johnson Co. Wat. Dist.	290.75
	Kansas City	123.00
	Lawrence	162.40
	Liberal	153.15
	Ottawa	150.00
	Parsons	175.00
	Pittsburg	242.86
	Salina	160.80
	Topeka	133.30
	Wichita	249.00
	Leavenworth	180.19
Kentucky		
	Frankfort	97.75
	Hopkinsville	191.16
	Kenton Co. WD Com. #1	101.93
	Lexington	259.00
	Louisville	127.66
	Louisville Ext.	217.23
	Murray	136.11
	Newport	273.13
	Richmond	231.65
Louisiana		
	Alexandria	142.20
	Baton Rouge	148.00
	Jefferson Parish WD #1	205.00
	New Orleans	139.13
	Saint Bernard Parish	--
	Shreveport	153.75
Maine		
	Auburn	63.67
	Augusta	68.33
	Bangor	102.52
	Brunswick	151.52
	Gardiner	--
	Kennebec Wat. Dist.	82.00
	Kennebunk	377.00
Maine—Continued		
	Lewiston	50.14
	Portland	107.14
	Rockland	--
Maryland		
	Baltimore	110.00
	Cambridge	220.70
	Hagerstown	151.50
	Hannibal	134.58
	Rockville	--
	Salisbury	99.67
Massachusetts		
	Abington - Rockland	158.60
	Adams	--
	Agawam	152.67
	Attleboro	143.60
	Boston	--
	Braintree	350.00
	Chelsea	220.00
	Danvers	348.75
	Dartmouth	158.67
	Falmouth	158.33
	Fitchburg	60.83
	Franklin	--
	Lexington	130.00
	Longmeadow	--
	Marblehead	300.00
	Medford	231.44
	Milford	193.83
	Natick	83.83
	Newburyport	63.73
	North Andover	132.40
	Reading	255.23
	Salem	--
	Scitjate	--
	Shrewsbury	188.07
	Springfield	105.33
	St. Cloud	120.00
	Swansea	--
	Taunton	123.70
	Tewksburg	263.25
	Wareham	--
	Watertown	190.00
	Wayland	--
	Webster	160.00
	West Springfield	125.00
	Weymouth	125.30
	Wilmington	155.75
	Worcester	142.50
Michigan		
	Adrian	136.10
	Allen Park	151.00
	Ann Arbor	142.17
	Bay City	131.33
	Berkley	336.27
	Birmingham	65.17
	Dearborn	150.43
	Detroit	89.79
	East Detroit	140.73
	East Grand Rapids	230.83

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] – Continued

State	City	Metered rates per 100,000 cu. ft.
		Dollars
Michigan—Continued		
	Escanaba	107.10
	Flint	159.23
	Grand Rapids	110.40
	Highland Park	95.17
	Jackson	68.50
	Kalamazoo	106.67
	Lansing	153.90
	Marquette	54.40
	Menominee	122.00
	Midland	156.67
	Monroe	145.78
	Mount Clemens	113.10
	Niles	71.30
	Oak Park	337.50
	Oakland Co. Wat. Auth.	--
	Owosso	125.51
	Pontiac	74.03
	Roseville	111.32
	Saginaw	122.70
	Traverse City	61.12
	Wyandotte	76.68
	Wyoming	99.61
Minnesota		
	Austin	111.30
	Brainerd	99.90
	Brooklyn Center	262.50
	Cloquet	--
	Coon Rapids	151.10
	Duluth	149.00
	Edina	179.40
	Fairmont	--
	Faribault	95.00
	Fergus Falls	170.40
	Fridley	329.50
	Hibbing	270.00
	Minneapolis	200.00
	Moorhead	173.50
	New Ulm	93.81
	Owatonna	80.66
	Robbinsdale	150.00
	St. Cloud	120.00
	St. Louis Park	200.00
	St. Paul	185.00
	Willmar	72.53
Mississippi		
	Columbus	--
	Greenville	111.70
	Greenwood	92.55
	Hattiesburg	173.70
	McComb	99.35
	Meridian	172.35
	Vicksburg	156.30
Missouri		
	Cape Girardeau	209.75
	Carthage	222.50
	Independence	298.77
	Joplin	173.02
	Kansas City	131.60
	Kennett	--
	Lees Summit	--
	Marshall	--
	Poplar Bluff	126.25
	Raytown	303.65
	Saint Joseph	133.30
	Springfield	309.04
	St. Charles	260.90
	St. Louis	103.04
	St. Louis Co. WA.	202.21
Montana		
	Anaconda	--
	Billings	105.84
	Bozeman	183.00
	Butte	242.65
	Great Falls	140.00
	Kalispell	109.20
	Missoula	125.50
Nebraska		
	Beatrice	127.50
	Bellevue	--
	Columbus	100.80
	Fremont	53.00
	Grand Island	73.30
	Kearney	82.00
	Lincoln	90.92
	Norfolk	84.35
	North Platte	66.75
	Omaha	125.40
	Scottsbluff	63.75
	Las Vegas	107.82
	Reno	--
New Hampshire and Vermont		
	Berlin	128.23
	Keene	77.33
	Laconia	108.08
	Manchester	151.00
	Nashja	113.88
New Jersey		
	Bernardsville	--
	Beverly	--
	Butler	--
	Camden #1	130.50
	Camden #2	220.31
	Collingswood	203.10
	Commonwealth Wat. Co.	289.63
	Denville	49.25
	East Orange	223.33
	Elizabeth	210.67
	Gloucester City	--
	Haddonfield	--
	Jersey City	120.00
	Kearny	190.04
	Little Falls	--
	Millville	150.00
	Monmouth Consol. Wat. Co.	174.25
	Montclair	221.91
	New Brunswick	--
	Newark	127.90

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
		Dollars
New Jersey—Continued		
	Nutley	202.90
	Palmyra	--
	Ridgewood	185.80
	South Amboy	--
	South Orange	--
New Mexico		
	Alamagordo	162.95
	Albuquerque	136.45
	Artesia	94.35
	Clovis	143.68
	Gallup	123.00
	Hobbs	132.18
	Las Cruces	211.66
	Las Vegas	190.20
	Lovington	--
	Rosswell	89.00
	Santa Fe	214.75
New York		
	Albany	240.00
	Buffalo	62.26
	Citizens Wat. Co. Newtown	420.00
	Corning	105.50
	Dobbs Ferry	274.54
	Elmira	99.18
	Garden City	185.72
	Geneva	128.11
	Goversville	103.00
	Greenburgh	--
	Hornell	50.00
	Ithaca	138.88
	Jamaica	176.04
	Jamestown	270.00
	Johnson City	83.11
	Long Is. Water Corp.	276.15
	Massapequa	150.00
	Massena	75.90
	Monroe Co. Wat. Auth.	216.18
	Mount Vernon	159.67
	Newark	292.18
	Newburgh	123.44
	New Rochelle Water Co.	238.68
	New York City	150.00
	Olean	158.60
	Scarsdale	208.17
	Syracuse	141.00
	Tonawanda	--
	Troy	--
	Watertown	112.28
	Westchester Jt. Water Works	246.50
	Yonkers	168.00
	Utica	178.82
North Carolina		
	Chapel Hill	90.00
	Concord	126.67
	Dunn	--
	Durham	188.97
	Elizabeth City	144.90
	Fayetteville	153.10
	Gastonia	193.00
North Carolina—Continued		
	Goldsboro	166.33
	Greenville	92.50
	High Point	184.48
	Lenoir	--
	Morehead City	--
	Reidsville	307.35
	Wilmington	167.20
	Wilson	138.94
North Dakota		
	Bismark	--
	Dickinson	--
	Fargo	147.92
	Grand Forks	239.47
	Mandan	166.69
	Minot	390.54
Ohio		
	Akron	190.07
	Ashland	237.22
	Ashtabula	260.80
	Avon Lake	190.85
	Bellaire	113.25
	Berea	190.11
	Cambridge	118.17
	Chillecothe	399.00
	Cincinnati	146.00
	Circleville	136.50
	Cleveland	87.78
	Cleveland Heights	255.00
	Columbus	170.95
	Coshocton	122.00
	Cuyahoga Falls	182.17
	Dayton	118.82
	Delaware	177 33
	East Liverpool	70.17
	Fairborn	183.67
	Findlay	189.35
	Fostoria	286.00
	Greenville	32.92
	Hamilton	271.50
	Lake Erie West	177.23
	Lima	122.00
	Lorain	135.20
	Mahoning Valley San. Dist.	--
	Marion	362.00
	Martins Ferry	131.91
	Massilon	203.15
	Montgomery Co. S. D.	145.33
	Newark	174.77
	Niles	105.50
	Plainesville	141.60
	Port Clinton	--
	Portsmouth	213.80
	Salem	135.52
	Sidney	215.83
	Struthers	302.77
	Tiffin	169.30
	Toledo	126.40
	Troy	146.17
	Xenia	118.90
	Zanesville	252.80

See footnote at end of table.

Table 10'—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
Oklahoma		*Dollars*
	Ada	110.66
	Bartlesville	230.30
	Durant	143.90
	Norman	371.15
	Oklahoma City	151.85
	Tulsa	155.05
	Seminole	177.59
Oregon		
	Astoria	93.81
	Coos Bay	142.90
	Eugene	72.94
	Grants Pass	87.73
	Medford	63.05
	Pendleton	66.59
	Portland	132.00
	Roseburg	126.29
	Salem	101.90
	Wolf Creek Hwy. WD	201.60
Pennsylvania		
	Allentown	87.55
	Ambler Boro	144.38
	Ambridge Boro	190.00
	Beaver Falls	220.40
	Bloomsburg	107.80
	Bradford	92.48
	Carlisle	74.24
	Chambersburg	88.00
	Charleroi	167.70
	Chester	185.47
	Clearfield	--
	Ellwood City	102.66
	Erie	54.60
	Franklin	94.70
	Hanover	103.25
	Harrisburg	80.67
	Hatboro	--
	Johnstown	174.85
	Lansdale	--
	Lansford-Coaldale Jt.	--
	Lewistown	65.60
	Latrobe	188.00
	Lock Haven	123.16
	Meadville	129.86
	Monongahela	--
	Monroeville	545.60
	Mount Carmel	251.09
	Muhlenberg Twp. Auth.	224.72
	Nazareth	--
	N. Versailles Twp. Auth.	306.83
	Northampton	--
	Oakmont	--
	Oil City	295.97
	Philadelphia	119.11
	Philadelphia Suburban	130.32
	Philipsburg	--
	Pittsburgh	271.40
	Pottstown	107.83
	Reading	194.40
	Sayre	--
	Shamokin	152.33
Pennsylvania—Continued		*Dollars*
	Shenango Valley Wat Co.	325.76
	Shillington	117.05
	S. Pittsburgh Wat. Co.	313.55
	Washington	220.34
	Waynesboro	92.13
	Wilkinsburg Penn. Jnt	211.16
	Williamsport	127.45
	Windber	--
	York	127.94
Rhode Island		
	Kent Co. Wat. Auth.	252.00
	Providence	105.30
	Warwick	132.50
	Westerly	157.50
South Carolina		
	Anderson	122.24
	Columbia	250.00
	Greenville	125.47
	Greenwood	167.05
	Greer	--
	Orangeburg	154.50
	Rock Hill	143.80
South Dakota		
	Aberdeen	252.71
	Brookings	188.47
	Mitchell	--
	Rapid City	172.15
	Sioux Falls	108.90
	Watertown	90.88
Tennessee		
	Athens	167.32
	Bristol	90.00
	Cleveland	--
	Columbia	136.00
	Cookeville	188.08
	Fountain City	273.38
	Greenville	174.15
	Madison	201.73
	Memphis	152.70
	Nashville	95.60
	Oak Ridge	151.70
	Paris	--
	Tullahoma	162.60
Texas		
	Andrews	198.63
	Arlington	172.35
	Austin	118.95
	Brown Co. WCID #1	--
	Brownfield	153.60
	Brownsville	108.45
	Brownwood	150.00
	Dallas	259.82
	Dumas	--
	Eagle Pass	140.74
	El Paso	164.15
	Farmers Branch	204.90
	Fort Worth	230.70

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
Texas—Continued		*Dollars*
	Garland	169.09
	Haltom	267.40
	Harlingen	135.36
	Houston	175.84
	Irving	52.50
	Kingsville	135.00
	Lamesa	215.81
	Levelland	198.95
	Lubbock	197.95
	Midland	271.10
	Nacogdoches	136.47
	Nederland	229.20
	New Braunfels	93.30
	Odessa	307.16
	Palestine	115.30
	Port Arthur	280.90
	San Angelo	187.50
	San Antonio	--
	Sherman	242.10
	Snyder	264.45
	Sweetwater	233.50
	Temple	199.63
	Tyler	119.70
	Waco	139.36
	Wichita Falls	215.75
Utah		
	Kearns	143.74
	Salt Lake City	121.50
	Toole	152.65
Vermont (see New Hampshire)		
Virginia		
	Alexandria	237.04
	Arlington	194.00
	Bristol	175.10
	Charlottesville	134.93
	Covington	82.50
	Danville	108.80
	Fredericksburg	99.87
	Henrico Co. Pub. Util.	--
	Lynchburg	200.28
	Newport News	164.17
	Norfolk	188.83
	Petersburg	122.73
	Portsmouth	213.80
	Radford	215.57
	Richmond	101.36
	Roanoke	191.01
	Salem	174.00
	Washington Co. S.D.	102.90
	Waynesboro	158.78
Washington		
	Alderwood Manor W.D.	201.60
	Auburn	63.00
	Bellevue	155.85
	Bellingham	98.40
	Bremerton	163.25
	Clarkston	102.50
	Edmonds	--
Washington—Continued		*Dollars*
	Hoquiam	92.83
	Kennewick	103.50
	Longview	121.74
	Mountlake Terrace	--
	Olympia	58.90
	Olympia View Wat. Dist.	--
	Pasco	91.75
	Port Angeles	125.40
	Puyallup	48.45
	Renton	115.80
	Richland	69.65
	Seattle	100.70
	Skagit Co. PUD #1	99.05
	Spokane	108.75
	Vancouver	88.85
	Walla Walla	81.43
	Wenatchee	93.80
West Virginia		
	Beckley	--
	Bluefield	228.15
	Charleston	230.35
	Elkins	127.50
	Fairmont	146.25
	Martinsburg	100.94
	Parkersburg	122.60
	Vienna	--
	Wheeling	118.44
Wisconsin		
	Allojez	121.24
	Appleton	123.10
	Ashland	167.25
	Beaver Dam	168.75
	Beloit	--
	Chippewa Falls	81.12
	De Pere	105.50
	Eau Claire	110.30
	Fond Du Lac	131.67
	Green Bay	141.75
	Janesville	73.83
	Kaukauna	85.88
	Kenosha	108.33
	La Crosse	67.50
	Madison	98.50
	Manitowoc	62.62
	Marinette	127.05
	Marshfield	160.60
	Menasha	97.30
	Milwaukee	123.43
	Neenah	158.80
	Oshkosh	111.70
	Preble	60.16
	Racine	136.83
	Sheboygan	120.58
	Shorewood	191.67
	South Milwaukee	119.97
	Stevens Point	74.73
	Two Rivers	116.50
	Watertown	83.42
	Waukesha	179.23
	Wausau	111.80

See footnote at end of table.

Table 10.—Metered water rates by city and State[1] — Continued

State	City	Metered rates per 100,000 cu. ft.
		Dollars
Wisconsin—Continued		
	West Allis	152.50
	West Bend	--
Wyoming		
	Casper	149.50
	Cheyenne	73.36
	Laramie	48.87
	Rock Springs	339.30
Puerto Rico		
	Puerto Rico Aqueduct and SA	182.21

[1] SOURCE: American Water Works Association, Inc., 2 Park Ave., New York, N.Y. 10016.

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